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2–6 Rules for Multiplication

Objective: To multiply real numbers.

Properties	Examples
Identity Property of Multiplication The product of a number and 1 is identical to the number itself. $a \cdot 1 = a$ and $1 \cdot a = a$	$6 \cdot 1 = 6$ and $1 \cdot 6 = 6$
Multiplication Property of Zero When one of the factors of a product is zero, the product itself is zero. $a \cdot 0 = 0$ and $0 \cdot a = 0$	$6 \cdot 0 = 0$ and $0 \cdot 6 = 0$
Multiplication Property of -1 For every real number a: $a(-1) = -a$ and $(-1)a = -a$	$6(-1) = -6$ and $(-1)6 = -6$ $(-5)(-1) = -(-5) = 5$ and $(-1)(-5) = -(-5) = 5$
Property of Opposites in Products For all real numbers a and b: $(-a)(b) = -ab$ $a(-b) = -ab$ $(-a)(-b) = ab$	$(-4)(5) = -20$ $4(-5) = -20$ $(-4)(-5) = 20$

Rules for Multiplication

1. If two numbers have the *same* sign, their product is positive.
   If two numbers have *opposite* signs, their product is negative.
2. The product of an *even* number of negative numbers is positive.
   The product of an *odd* number of negative numbers is negative.

Example 1 Multiply: **a.** $3(6)$ **b.** $(-3)(6)$ **c.** $3(-6)$ **d.** $(-3)(-6)$

Solution
a. $3(6) = 18$ (Both factors have the same sign.)
b. $(-3)(6) = -18$ (The two factors have opposite signs.)
c. $3(-6) = -18$ (The two factors have opposite signs.)
d. $(-3)(-6) = 18$ (Both factors have the same sign.)

Example 2
a. $2(-3)(-4)(-5)$ is negative because it has 3 negative factors.
b. $(-1)(-4)(-5)(6)(-7)$ is positive because it has 4 negative factors.
c. $(-6)(7)(0)(-4)$ is zero because it has a zero factor.

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2–6 Rules for Multiplication *(continued)*

Multiply.

1. $(-12)(-3)$ **36**
2. $18(-4)$ **-72**
3. $2(17)$ **34**
4. $18(0)$ **0**
5. $(-2)(5)(-8)$ **80**
6. $(4)(-7)(10)$ **-280**
7. $(-2)(-3)(-4)$ **-24**
8. $(-11)(-12)(0)$ **0**
9. $35(-26)(0)$ **0**
10. $5(-2)(-8)(-5)$ **-400**
11. $(-7)(3)(-1)(2)$ **42**
12. $(-8)(-5)(-1)(-3)$ **120**

Example 3 Simplify: **a.** $(-2x)(-6y)$ **b.** $3y + (-7y)$

Solution
a. $(-2x)(-6y) = (-2)x(-6)y$
$= (-2)(-6)xy$
$= 12xy$

b. $3y + (-7y) = [3 + (-7)]y$
$= (-4)y$
$= -4y$

Simplify.
13. **$12ab$** 14. **$30xy$** 15. **$-10pq$** 16. **$-28ef$** 17. **$30ab$**
18. **$-15a$** 19. **$-3x$** 20. **$5x$** 21. **$-8y$** 22. **0**

13. $(-3a)(-4b)$
14. $(5x)(6y)$
15. $2p(-5q)$
16. $(-4e)(7f)$
17. $(-6a)(-5b)$
18. $-7a + (-8a)$
19. $2x + (-5x)$
20. $8x + (-3x)$
21. $(-11y) + 3y$
22. $-4n + 4n$

Example 4 Simplify: **a.** $-3(2x - y)$ **b.** $5x - 4(x - 1)$

Solution
a. $-3(2x - y) = -3(2x) - (-3)(y)$
$= -6x - (-3y)$
$= -6x + 3y$

b. $5x - 4(x - 1) = 5x - (4x - 4 \cdot 1)$
$= 5x - (4x - 4)$
$= 5x - 4x + 4$
$= x + 4$

Simplify.

23. $-6(x - 2y)$ **$-6x + 12y$**
24. $-5(2c + d)$ **$-10c - 5d$**
25. $-4(3m + 2n)$ **$-12m - 8n$**
26. $-7(-4y - 5)$ **$28y + 35$**
27. $(3x - 5)(-6)$ **$-18x + 30$**
28. $(-3 + 5y)(-2)$ **$6 - 10y$**
29. $4x - 3(x - 2)$ **$x + 6$**
30. $6x - 2(x + 3)$ **$4x - 6$**
31. $3x - 5(x - 1)$ **$-2x + 5$**
32. $(-1)(a - b + 2)$
33. $(-1)(2x - y - 3)$
34. $(-1)(x + y - z)$
35. $4x - 2x + 7 + x$
36. $2y - 5 - 5y + 3$
37. $11p - 6c - 7c + 9p$

32. **$-a + b - 2$** **33.** **$-2x + y + 3$** **34.** **$-x - y + z$**
35. **$3x + 7$** **36.** **$-3y - 2$** **37.** **$20p - 13c$**

Mixed Review Exercises

Translate each sentence into an equation.

1. Three times a number is 27. **$3n = 27$**
2. The quotient of n and 4 is 15. **$\frac{n}{4} = 15$**
3. One half of a number is nine. **$\frac{1}{2}n = 9$**
4. Six less than twice a number is 14. **$2n - 6 = 14$**

Simplify.

5. $110 - (12 - 8)$ **106**
6. $161 - (8 - 11)$ **164**
7. $2 + (-5) + (-y) + 9$ **$6 - y$**
8. $3(20 + 5)$ **75**
9. $2n + (-5n)$ **$-3n$**
10. $5(n + 1) + 7$ **$5n + 12$**

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